

REMARKS

Claims 1-35 are pending

I. Claim Rejections Under 35 U.S.C. §112.

Claims 1-25, 26-28 and 29-35 stand rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP §2172.01.

These points are respectfully amended per the Examiner's suggestions. See for example Claim 1:

"receiving the transmitted encrypted data and converting the received encrypted data to the spatial domain using threshold sampling to avoid overlap between adjacent data in the transmitted encrypted data; and"

Applicants respectfully thank the Examiner for the suggestions.

II. The obviousness rejections in view of the combination of Javidi and Sun.

Claims 1-35 stand rejected under 35 U.S.C. 103(a) as being obvious over Javidi et al. (US Patent 5,903,648) in view of Sun et al. ("All-Optical Parallel-to-Serial Conversion by Holographic Spatial-to-Temporal Frequency Encoding").

The independent claims have been amended in accordance with the below explanation. No new matter is added. Reconsideration is respectfully requested.

The inventors, who are well known in the field, used complex value notation and performed a numerical analysis (see page 17) and found a novel way to avoid errors caused by overlap in reconstructed decrypted spatial data. For example, the size of a pixel of encrypted data in a receiver may be expanded in proportion to the width of the optical pulse due to the space-to-time and time-to-space converters as is well known. (page 20 bottom).

Thus, the inventors respectfully assert that it is not obvious to reconstruct original binary data from the sampled encrypted data that are optically encrypted complex-valued data to avoid the overlap of the encrypted data after the data transmission based on ultrafast optics

by sampling of the encrypted data using thresholding. See pages 18-20.

See for example, page 18 of the present specification wherein it is stated: "By use of binary data it was possible to reduce the noise in the decrypted data by thresholding" and the remainder of page 18. See mean-squared error equation 27. Mean-square error "e" is shown as a function of the sampling interval " Δ " delta in Figure 6. At the bottom of page 18, it is discussed that when the sampling interval $\Delta = 1$ the original data can be reconstructed without error. The average mean squared error was calculated over a 1000 trials (page 18, bottom). At page 19, it is discussed that in order to determine the threshold levels the energies of the pixels were "rank ordered" where N is the number of bright pixels (1's) in the original binary data.

Thus, as described at pages 19-21, the inventors have developed an ultrafast encrypted data communication system, using spatial-temporal converters. They have analyzed the proposed system and have presented a numerical evaluation of the effect of sampling of the spatially encrypted data on the quality of reconstructed data. When the encrypted data are undersampled, the loss of the encrypted data results in error in the decryption of the data. They have shown that it is possible to recover the original binary data by thresholding especially when the pulse width is smaller than the sampling interval of encrypted data and the sampling interval is short. When the incorrect phase mask is used in the decryption process, the original data cannot be reconstructed. Thus, the proposed system has the potential to implement data transmission with high security and an ultrafast transfer rate.

Sun et al.

Sun's paper showed that the optical pulse will be broaden after the data transmission based on space-to-time and time-to-space conversion as is well known. Sun's paper, however, did not discuss the transmission of complex-valued information of ultrashort pulse and also did not discuss the claimed sampling or the sampling data for the reconstruction of encrypted data.

See for example at page 10 the present specification wherein Sun is discussed and it is noted -- that in contrast to Sun -- in the present invention "a complex value notation was introduced here simply because optical encryption generates complex data."

For example, see page 16 bottom to page 17 and equation 24 of the present application

wherein the complex conjugate of the sampled encrypted signal of equation 10 (page 12) is reconstructed. Nothing like this is done in Sun and this present complex notation analysis helped the inventors develop the sampling method as claimed for example.

Javidi, US 5,903,648

Prof. Javidi's patent regarding the double random phase encryption did not disclose the claimed sampling or the reconstruction of the sampling (see page 17 equation 24) of the encrypted data.

As claimed herein, a sampling interval should be provided appropriately for the reduction of bit error in the proposed ultrafast data communication with data encryption.

The present specification also demonstrated numerically the evaluation of the influence of the sampling.

The references were discussed in the Background section.

Overall, it is also noted that Sun's paper was discussed by applicants in the Background section of the invention at page 10 and double phase encryption of Professor Javidi is also discussed because Prof. Javidi is one of the present inventors and the process may be used herein. Therefore, although these two references are related to the field, they are background references which do not teach or suggest the limitations of the independent claims, especially in regard to the claimed sampling.

Thus, as the independent claims are respectfully asserted to be allowable, so too are the remaining dependent claims.


III. Conclusion.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Please telephone the undersigned for any reason. Applicants seek to cooperate with the Examiner and to expedite prosecution.

Respectfully submitted,

By 
Daniel P. Lent
Registration No. 44,867

Date: December 19, 2005
CANTOR COLBURN LLP
55 Griffin Road South
Bloomfield, CT 06002
Telephone (860) 286-2929, Ext. 1137
Facsimile (860) 286-0115
Customer No.: 23413